



زانكۆی سه‌لاحه‌دین – هه‌ولێر

Salahaddin University-Erbil

Morphological and Medical Use of Gastropoda

Research project

Submitted to the Department of Biology in Partial fulfillment of the Requirement for the degree of BSc.in Biology

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April, 2023

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قُلْ لِيُؤْتِكُمْ
عِلْمًا
مِنْ لَدُنِّهِ
يَزِيدُ
بِذَقِ
وَيُزِيدُ

سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

DEDICATION

This work is dedicated to:

To my Family

To my Teachers

To my Friends

ACKNOWLEDGMENTS

In the name of Allah, the most gracious and most merciful all praise be to Allah, the lord of the world, and peace be upon Muhammed his messenger.

I give especial and truly thanks to my best supervisor professor Dr. Luay A. Ali for his guidance and trustfulness, and help throughout the period of my study.

I am so happy to gratitude to Salahadden University-Erbil, and special thanks are to Dean of College of Education-Shaqlawa and Head and Staff of biology department for giving me an opportunity to complete this study.

Great thanks to my dear friend (Sumaya Sabah Abas) which be helpful to me, and to my relative, all friends and classmate for their support during conducting this study

Finally I express my deep thanks to my family for their support and hopeful words especially my mother.

Summary

Gastropods are a type of Mollusca, they are also the most diverse group, comprising between 40,000 and 100,000 species, nearly 80% of the entire Mollusca phylum. Most gastropods have a shell that is outside of their body, symmetrically coiled and unchambered, they are characterized by the possession of a single (often coiled) shell, although this is lost in some slug groups, and a body that has undergone torsion so that the pallial cavity faces forwards. Typically, they have a large foot with a flat sole for crawling, a single coiled shell that covers the soft body, and a head that bears a pair of eyes and tentacles. However, they are so diverse that some forms lack shells, while animals in one genus have shells with two halves, like bivalves.

Mollusca are used directly as a food source may also contribute to the prevention of disease by providing essential nutrients, as well as immunostimulatory compounds and other secondary metabolites with direct biological activity

Gastropod also benefits for humans from the health side for example: Snail water also decreases blood pressure; high blood pressure is linked to stroke; by reducing blood pressure, stroke risk is reduced and Garden snail slime, as an ingredient in “cosmeceuticals” (a hybrid cosmetic and pharmaceutical product), is collected from live snails, filtered, and then added to other ingredients to make various skin products, some of which show promise in small studies to heal sunburn and accelerate wound repair, also in general, the field of beautifying snail mucin products are suitable for all skin types, although people with dry skin may notice the hydrating properties more than those with oily skin. It is also generally safe for acne-prone or sensitive skin.

Key word: Gastropod, Mollusca, Bivalve, Aquatic, terrestrial Snail.

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INTRODUCTION

Gastropods (phylum Mollusca) are comprised of more than 80,000 species and are differentiated from other classes of mollusca by the presence of a torsed body. They are separated into three subclasses: Prosobranchia, Opisthobranchia, and Pulmonata. They are found in terrestrial, freshwater and marine environments. All gastropods possess a ventrally flattened foot that provides locomotion (Smolowitz R. Gastropods.2012)). Over 2000 species are reported in the International Union for Conservation of Nature (IUCN) Red List as critically endangered, endangered or vulnerable, with 14 species listed as extinct in the wild. Over 1500 other species cannot be classified due to a deficiency in data.

In the scientific literature, gastropods were described as "gasteropodes" by Georges Cuvier in 1795. The word gastropod comes from Greek γαστήρ (gastér 'stomach') and πούς (pous 'foot'), a reference to the fact that the animal's "foot" is positioned below its guts. The earlier name "univalve" means one valve (or shell), in contrast to bivalves, such as clams, which have two valves or shells.

Moreover, they are asymmetrical molluscs that underwent torsion. The body is generally divided into 2 main regions: (1) head-foot and (2) mantle (including shell), mantle cavity, and visceral mass. In most gastropods the muscular foot is the locomotion organ; they mainly crawl, attach, or burrow using the foot. (Coleman et al., 2014)

The Class Gastropoda includes the groups pertaining to snails and slugs, which is used as a beautifying for the skin, snail secret has snail mucus as its effective active ingredient. The mucous was found to be an efficient producer of collagen, glycolic as well as various other material that helps in restoring your skin. It is also the snail sludge that contains healthy protein, hyaluronic acid and also anti-oxidants. It is likewise used in elegance cosmetics with moisturizing impacts. The numerous elements that assist in providing you a healthy and balanced skin are evidence that snail secret is a reliable solution to various skin troubles.

Snail slime has hit the beauty market in spectacular fashion, enhancing face creams, moisturizers, gel masks, and skin repair serums. It treats multiple skin issues. Snail mucin is known to treat a variety of skin issues like dry skin, wrinkles and stretch marks, acne, rosacea, age spots, burn marks, scars, razor bumps and warts. It can soothe irritated skin - A key component found in snail mucin is allantoin.

Also, Snail increases the production of hyaluronic acid and of collagen and elastin fibers, which helps the skin achieve and maintain a healthy appearance. It also helps diminish the appearance of wrinkles and combats dryness, improving the skin's flexibility and giving it a smoother and firmer texture. It helps solve hair problems HELIX ASPERSA MULLER snail extract, one of the finest in cosmetics, gives vigor and volume to hair that is dry, brittle or heavily damaged by technical treatments, thermal and atmospheric stress. It helps to make the hair softer, more elastic, hydrated, bright and easier to comb. (Chatzinikolaou et al., 2019)

Aim of Study

In this research, our aim is to introduce different forms of gastropoda in general and also talk about the benefits and harms of gastropoda on organisms in general medically

LITERATURE REVIEW

General Morphology

Most adult gastropods are bilaterally asymmetrical organisms with common features: (1) a well-developed head, bearing eyes and a variable number of tentacles; (2) a prominent muscular foot with a ventral surface that forms a flat, creeping sole; (3) a radula (rasp tongue) used for the procurement of food; (4) an anteriorly and laterally displaced anus; and (5) a single, often spiral shell with a mantle lining its last whorl (Fig. 1). The shell generally provides protection to the posterior end of the animal and several internal organs that are assembled in the dorsal visceral hump. Many aquatic snails (and a few terrestrial species) carry a hard operculum attached to the dorsal, posterior surface of the foot that closes the aperture when the snail withdraws into the shell. While, the preceding description paints a picture of a typical gastropod, many representatives of this taxon have body plans that differ significantly. For example, adult marine and terrestrial slugs either have no shell at all or only a greatly reduced and internalized vestige of this structure. As another example, the foot of pteropod mollusca has evolved into a wing-like structure, used not for crawling but rather for swimming within the water column. Additional general descriptions of the structure of different visceral organs, shell, digestive, and reproduction systems as well as physiological, behavioral, and evolutionary aspects of gastropod biology can be found elsewhere.

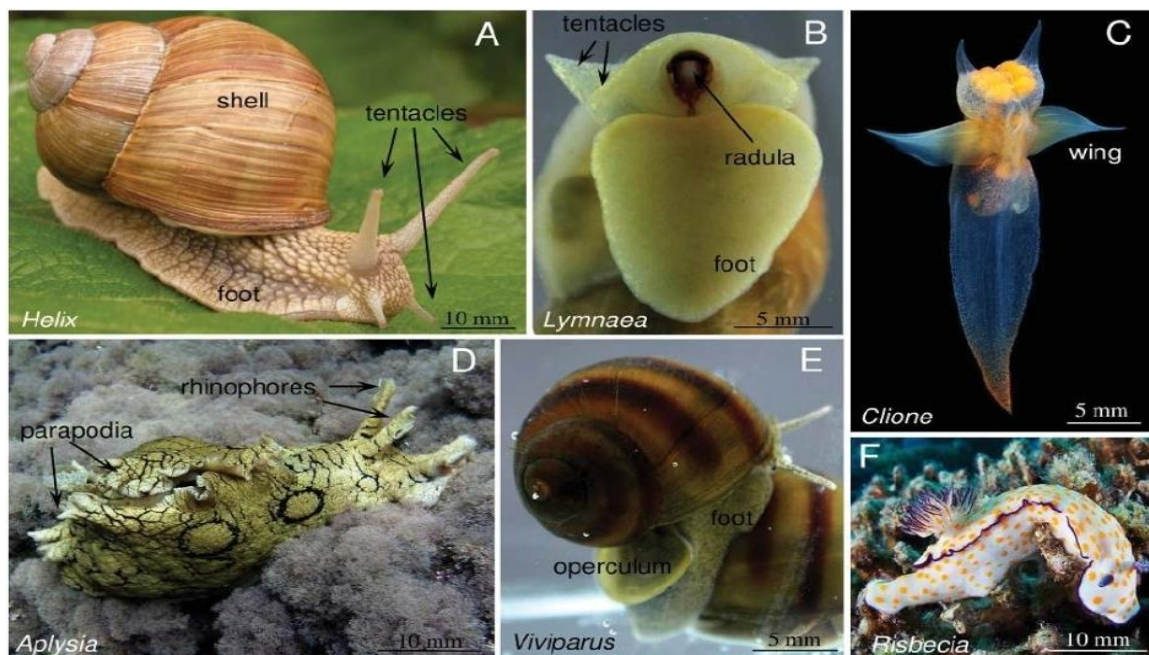


Fig. 1 Gastropods with different body forms.

A: A typical terrestrial gastropod, *Helix*, is an asymmetrical animal with a single spiral shell, prominent muscular foot, and a well-developed head bearing tentacles (and eyes at the tips of the larger posterior set of tentacles). B: Like most gastropods, the freshwater snail, *Lymnaea*, uses a radula (rasp tongue) to procure its food. C: The foot of pteropod mollusc *Clione* has evolved into a wing-like structure, used for swimming within a water column. D: Sea slugs, like *Aplysia*, have no shell or only a greatly reduced and internalized vestige of this structure. E: Another aquatic snail, *Viviparus*, carries a hard operculum on the dorsal, posterior surface of the foot to close the aperture when the snail withdraws into the shell. F: Another sea slug, *Risbecia*, illustrates the bright colouration often found in these animals. (Ellis et al., 2009)

Material and Methods

The data were collected from previous published articles in different parts of the world.

Classification of gastropods

Most of the earlier gastropods classification methods were based upon morphological features to categorize these organisms and used taxon ranks like order, superorder and suborder which are typical of traditional classifications.

Bouchet and Rocroi (2005) have given a new system for the scientific classification of gastropods which was mainly based on the concept of clades and was taken from research on molecular studies. Gastropods are divided into groups called clades. Clades are collection of life forms that have descended from a common ancestor. In the Bouchet and Rocroi system, clades are employed between the rank of class and the rank of superfamily while the clades are unranked. There is a great deal of debate in the scientific community on the topic of the biological grouping of some species. They use six main clades: Patellogastropoda, Vetigastropoda, Cocculiniformia, Neritimorpha, Caenogastropoda and Heterobranchia, which are generally recognized by researchers. In the first three clades, there are no nesting clades within them, in other words, the taxonomy goes directly to the superfamily stage. There is one extra clade within the Caenogastropoda. In Heterobranchia clade, there are six separate clades above the level of superfamily for some of the nudibranch groups and there are four clades above the level of superfamily in the case of most of the land snails. Also, they used groupings of taxa as a “group” or an “informal group” instead of “clade” in some places of the classification. By definition, a clade should have only one lineage while “informal groups” may either include more than one lineage, or only include part of a lineage (González-Wevar et al. 2010).

Neritopsina

This group includes old gastropods with a long fossil record. They are known to occur in all shapes and sizes from coiled shells, to limpet-like, to slugs. This includes terrestrial, freshwater, and marine species.

Vetigastropoda

This clade includes top shells, abalone, keyhole and sliplimpets, and several other families.

Caenogastropoda

This group is highly diverse and has colonized almost all marine, freshwater, and terrestrial environments. This clade (large group) consist of about 60 % of extant gastropods and contains a large number of ecologically and commercially important marine families such as Muricidae, Volutidae , Mitridae, Buccinidae, Terebridae ,Conidae , Littorinidae, Cypraeidae, Cerithiidae , Calyptraeidae, Tonnidae , Cassidae , Ranellidae , Strombidae and Naticidae (Gaylord et al., 2011).

Heterobranchia

This group includes pulmonates (comprises more than 20,000 species) and opisthobranchs includes sea hares, sea slugs and bubble shells. This group includes the gastropod groups positioned by Thiele's taxonomic scheme into the 'Opisthobranchia' and 'Pulmonata', as well as some 'prosobranch' groups (Hain & Arnaud 1992).

Patellogastropoda

This is a major group of marine gastropods that contains true limpets, traditionally called Docoglossa. Patellogastropods are known to occur mostly on rocky shores in all continents.

Cocculiniformia

This group includes white limpets that attach to organic matter in the deep ocean.

Biology of Gastropods

Gastropods can be recognised by their large foot, tentacles, coiled shell (although this is sometimes small or absent) and the presence of torsion,

which is where the body is twisted round so that the anus, reproductive organs, mantle cavity and gills all point forwards. Gills occur in most aquatic forms, but in land snails, part of the mantle cavity is closed off to form a lung. Some marine gastropods, especially those that live on a muddy sea floor, have a tube (siphon) protruding from the front of the shell through which clean water is drawn into the mantle cavity (Kroeker et al., 2014).

The shell, which is the part that may be fossilised, is constructed in three layers:

- a thin, coloured outer layer
- a thin, mother-of-pearl inner layer
- a thick, calcareous middle layer

The shell may be planispirally coiled but more usually it is helicoidal, forming a spire with the original juvenile shell (protoconch) preserved at its apex. Sometimes there is a hollow, tube-like canal that holds the siphon during life. Many species carry a horny lid (operculum) on their foot to close the aperture of the shell after retracting inside.

Anatomy of Gastropoda

Snails are distinguished by an anatomical process known as torsion, where the visceral mass of the animal rotates 180° to one side during development, such that the anus is situated more or less above the head. This process is unrelated to the coiling of the shell, which is a separate phenomenon. Torsion is present in all gastropods, but the opisthobranch gastropods are secondarily untorted to various degrees.

Torsion occurs in two stages. The first, mechanistic stage, is muscular, and the second is mutagenetic. The effects of torsion are primarily physiological;

the organism develops an asymmetrical growth, with the majority occurring on the left side. This leads to the loss of right-paired appendages (e.g., ctenidia (comb-like respiratory apparatus), gonads, nephridia, etc.). Furthermore, the anus becomes redirected to the same space as the head. This is speculated to have some evolutionary function, as prior to torsion, when retracting into the shell, first the posterior end would get pulled in, and then the anterior. Now, the front can be retracted more easily, perhaps suggesting a defensive purpose.

However, this "rotation hypothesis" is being challenged by the "asymmetry hypothesis" in which the gastropod mantle cavity originated from one side only of a bilateral set of mantle cavities.

Gastropods typically have a well-defined head with two or four sensory tentacles with eyes, and a ventral foot, which gives them their name (Greek gaster, stomach, and pous, foot). The foremost division of the foot is called the propodium. Its function is to push away sediment as the snail crawls. The larval shell of a gastropod is called a protoconch.

The principal characteristic of the Gastropoda is the asymmetry of their principal organs. The essential feature of this asymmetry is that the anus generally lies to one side of the median plane.; The ctenidium (gill-combs), the osphradium (olfactory organs), the hypobranchial gland (or pallial mucous gland), and the auricle of the heart are single or at least are more developed on one side of the body than the other ; Furthermore, there is only one genital orifice, which lies on the same side of the body as the anus (Fig 2, 3 and 4) (Leung et al., 2020).

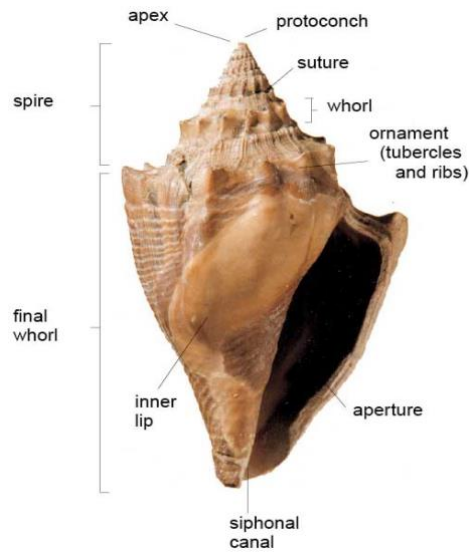
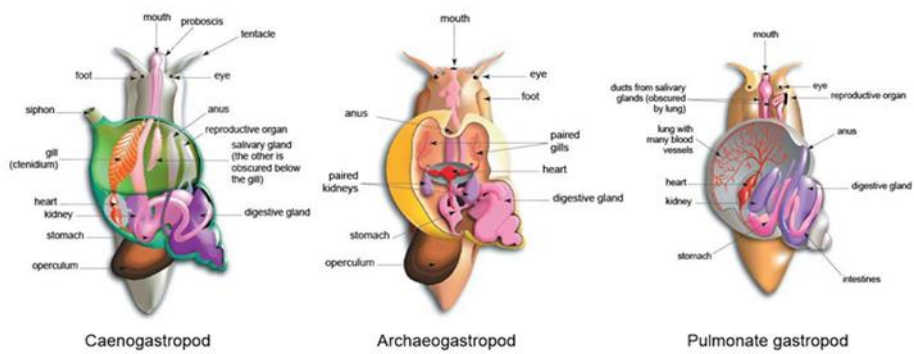
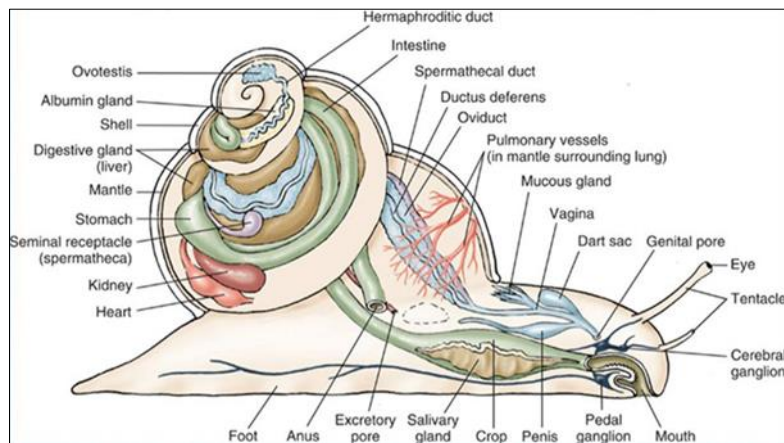


Fig. 2 The shapes main structures of snail shell



A



B

Fig. 3 Anatomy of snail

Medical use of Gastropoda

Gastropods play an important role in the life of organisms medically, especially humans, which are used as a treatment for many diseases, for example:

In addition to containing significant sources of protein and low amounts of fat, snails are also good sources of iron, calcium, Vitamin A, and a number of other minerals. Vitamin A helps your immune system fight off diseases and strengthens your eyes. It also helps cells in your body grow (Matozzo et al., 2013).

Medical Importance of Snail

Snail has the following important for human:

- Snails are a Good Source of Protein
- Snails are Low in Calories and are Good for Weight Loss
- Snails Contain Low Fat
- Snails are Rich in Vitamins and Minerals
- Iron and Magnesium
- Potassium
- Selenium
- Vitamin A
- Vitamins B3, B6, and B12
- Vitamin E
- Overall Cardiovascular Health is Enhanced by Snails
- Improve Your Mood and Overall Mental Health
- Snail Slime is Good for Skin Care
- How is Snail Slime Used in Beauty Products
- How is Snail Slime Used in Medicine

- Snail Venom is a Source of a Very Potent Analgesic
- Shell Powder of a Snail as a Supplement in Animal Feeds
- Final Thought

It is worth to mention, that the serum secreted by *Helix pomatia* snails (table 1) have a powerful antioxidants, which protect them from an atmosphere full of oxygen radicals. When the serum is applied to fibroblasts, it enhances the proliferation and functional capability of these cells. Fibroblasts are responsible for generating all the elements of the skin matrix, including collagen, elastin fibers, glycosaminoglycan and proteoglycans. The latter two provide firmness, strength, suppleness, and elasticity for the skin by containing water (Schrödl, 1999 and 2003).

Table 1 shows the information about *Helix pomatia* snails

Common Name	Snail
Latin Name	<i>Helix pomatia.</i>
INCI Name	Snail secretion Filtrate
Main component	protein, glucose, vitamins B, calcium, chondroitin sulfate.
Efficacy	Moisturizing, Anti-wrinkle, Anti-aging, Anti-Oxidant, Treating burn.

Chondroitin sulfate

is a sulfated glycosaminoglycan composed of a chain of alternating sugars (Nacetylgalactosamine and glucuronic acid). A chondroitin chain can have over 100 individual sugars, each of which can be sulfated in variable positions and quantities. Chondroitin sulfate is an important structural component of

cartilage and provides much of its resistance to compression. And also it has a very strong affinity with water and will draw in additional water (Fig. 4) (Vargas et al., 2013).

Chondroitin sulfate power

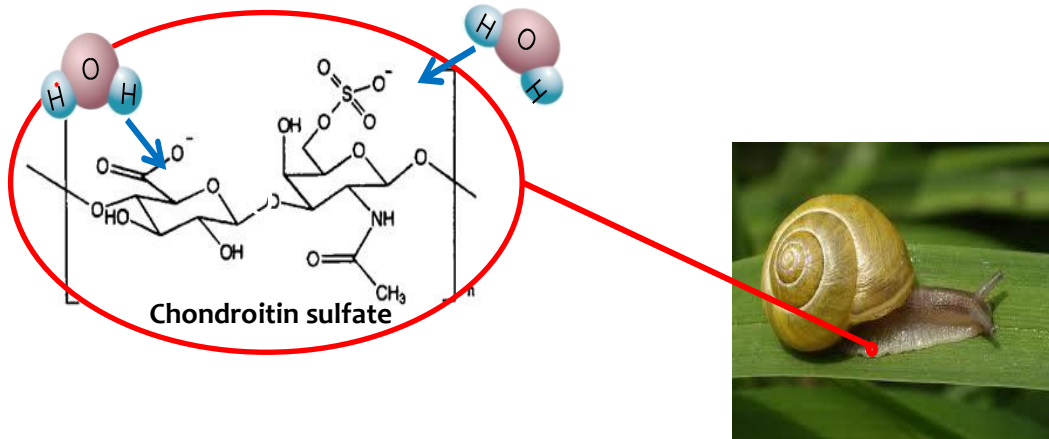


Fig. 4 chemical structure of Chondroitin sulfate

Efficacy

The data in this figure (5) shows the effect of Chondroitin sulfate on the hyaluronidase activity. A significant decrease in hyaluronidase activity (118 ± 16 U/ml) was shown at a concentration of Chondroitin sulfate of 0.1 mg/ml compared with that in the absence of Chondroitin sulfate (279 ± 18 U/ml). The hyaluronidase activities were progressively inhibited with increasing Chondroitin sulfate concentrations and completely blocked at concentrations of 10 μ g/ml or higher (Fig. 6).

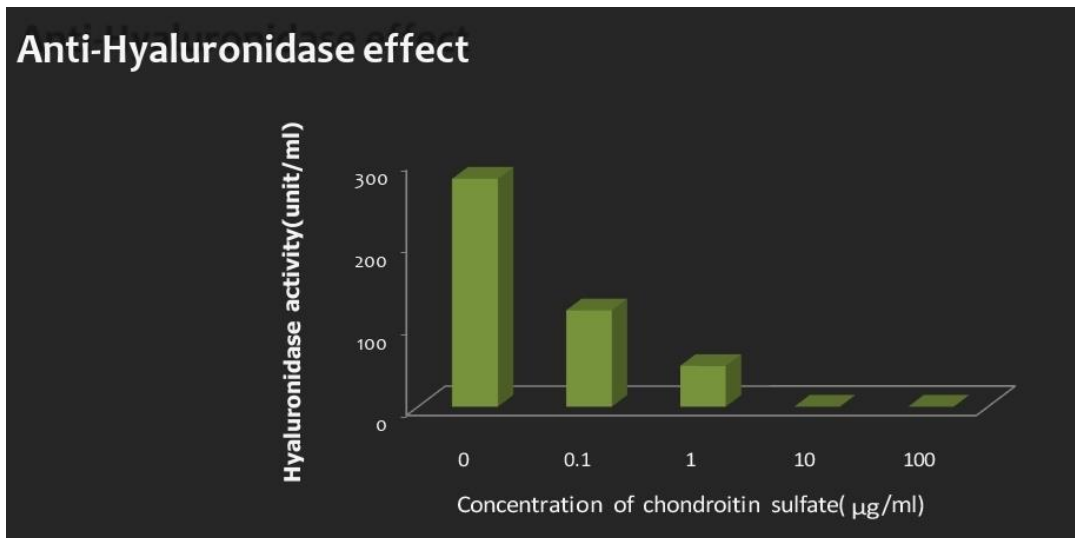


Fig. 5 Shows the effect of Chondroitin sulfate on the hyaluronidase activity.

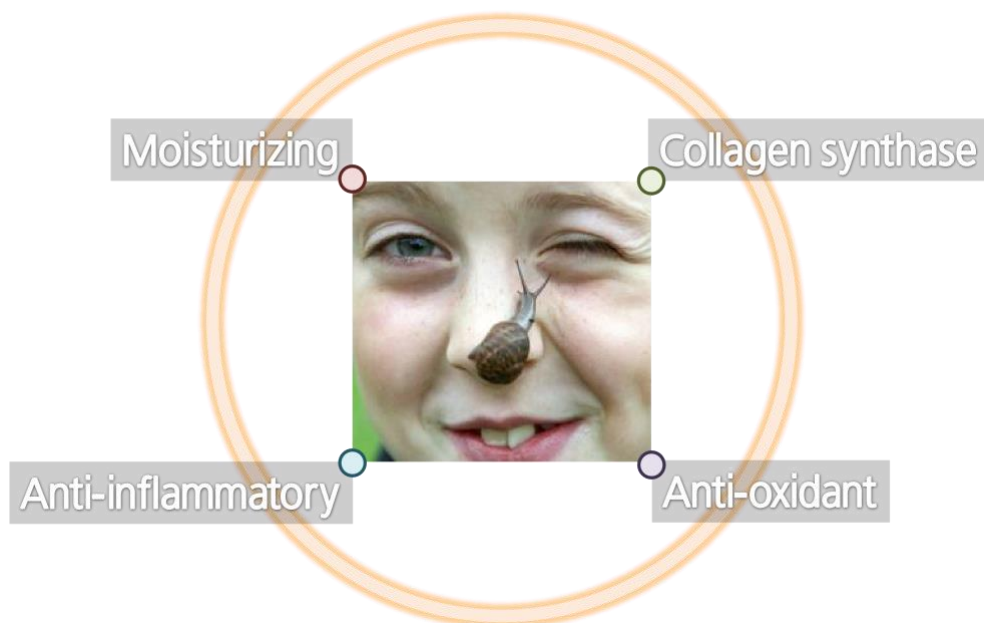


Fig 6 medical use of snail.

Most of Korea cosmetic brand has snail concept line. It is common ingredient for cosmetic field in Korea. Of course, Customer usually used to these kinds of products for moisturizing care. SNAIL extract can applied various type

cosmetic product. It can be applied cream, emulsion, BB cream, Mask pack and so on (Fig. 7) (Wägele 1991).

Conclusions:

This study deals with the morphology and internal and external structures of gastropods and their different shapes of this familiar group of invertebrates with the structures and functions of the body, which allows scientists to use this large group of gastropods for humanity It can be used as food and many other environmental benefits. in addition to the medical important of this group of invertebrates for human, that can be used as a treatment for many diseases, and for cosmetic purposes and extracting of many other medical products, so gastropods play an important role in human.

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